

Advances in Nanotechnology for Efficacious and stable Formulation Development

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Current operational medical kits aboard the International Space Station (ISS) include an array of medications intended for the treatment of minor ambulatory care symptoms, first aid, and basic life support. All medications contained in the flight kits are commercially available off-the-shelf formulations used for treatment of illnesses on Earth. However, transport and stowage of supplies including medications for space missions are exposed to adverse environmental conditions and extended shelf-life demands. Proposed missions to Mars and near-Earth objects such as asteroid 1999 AO10 will present crew health risk that is different both quantitatively and qualitatively from those encountered on ISS missions. Few drug options are available at the present time for mitigation of crew health risk of planned space exploration missions. Alternatives to standard oral formulations that include sustained and targeted delivery technologies for preventive healthcare in space will be a welcome addition to the space formulary and may include controlled release topical, sub-cutaneous, intranasal and inhalation dosage forms. An example of such a technology development endeavor can be nanotechnology-based multi-stage drug cocktail and vaccine delivery systems. Nanostructures also have the ability to protect drugs encapsulated within them from physiologic degradation, target their delivery with sustained release and are suitable for per oral routes of administration. The use of nanostructures such as polymeric nanoparticles offers a non-invasive approach for penetrating the blood brain barrier. Finally, nanotechnology offers great potential for the development of safe and efficacious drug delivery systems for preventive health care in space and on Earth.